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TITLE: THIN-FILM VAPOR PHASE GROWTH DEVICE

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ABSTRACT:

PROBLEM TO BE SOLVED: To allow scattering particles to be made to static-adhere to the dielec tric as a means for removing particles for collection by positioning the particle removing means around a susceptor when the inside of a reaction container is released at an atmospheric pressure or evacuated and by applying potential to an electrode by DC currecnt.

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means 11 and are
connected with the electrode 13. The member 14 is connected to a DC power
supply 16. A potential is applied to the electrode 13 through the DC power
supply 16 to charge the dielectric 12. The scattered particles at this time
are adhered to the dielectric 12 thanks to its static attracting force, thereby
preventing a substrate 2 for forming a film thereon from particle
contamination. The means 11 is lowered to the position of a dust receiver 17.
In such a state, the applied potential of the metallic electrode 13 is set to
reverse polarity or ground potential and the particles adhering on the
dielectric 12 are dropped into the receiver 17.

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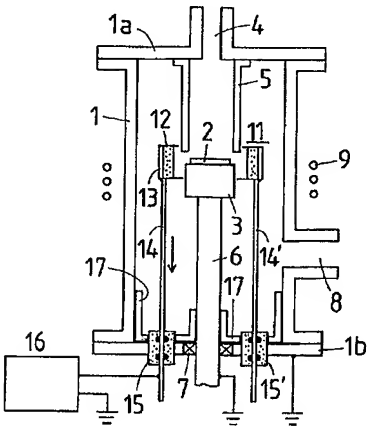
(54)【発明の名称】　薄膜気相成長装置

(57)【要約】

【目的】　被成膜基板のパーティクル汚染を防止すること。

【構成】　被成膜基板２はサセプタ３に載置されて、縦型の反応容器１の内部に配置される。基板の搬出入時、反応容器は大気圧に戻したり、真空引きされる。このとき、反応容器内壁、サセプタ、ガスフローチャネル５に付着していたパーティクルが飛散する。環状の誘電体１２とその外側面に取り付けた電極１３を有するパーティクル除去手段１１をサセプタの周囲を覆う位置に配置する。直流電源１６によって電極に所要極性の電位を与え、誘電体を帯電させてパーティクルを付着させる。反応容器の底部にゴミ受け１７を設け、支持部材１４，１４'を操作してパーティクル除去手段をゴミ受けまで下げ、電極に逆極性の電位或いはアース電位を与えることにより、パーティクルをゴミ受けに落す。



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【特許請求の範囲】

【請求項１】　原料ガスの熱分解反応により被成膜基板に薄膜を形成する気相成長装置において、縦型の反応容器と、被成膜基板を載置し、同基板を前記反応容器内に位置させるサセプタと、環状の誘電体及びこの誘電体の外側面に取り付けられた電極を有するパーティクル除去手段と、前記電極に電位を与える直流電源と、前記反応容器の底部に設けられたゴミ受けとを備え、前記パーティクル除去手段は前記サセプタの周囲を覆う位置と前記ゴミ受けの位置に昇降可能であることを特徴とする気相成長装置。

【発明の詳細な説明】

【０００１】

【産業上の利用分野】本発明は、有機金属薄膜気相成長装置等に係り、被成膜基板のパーティクル汚染を防止した気相成長装置に関する。

【０００２】

【従来の技術】有機金属薄膜気相成長（ＭＯＣＶＤ）装置等の気相成長装置は、原料を気体状（ガス）にして供給し、加熱した被成膜基板上で熱分解反応を生じさせて所望の薄膜を形成する。気相成長装置は大きく分けると、反応容器内に水平に置かれた被成膜基板に対して、原料ガスを水平方向、横から流す横型の気相成長装置と、垂直に原料ガスを吹き付ける縦型の気相成長装置がある。

【０００３】図２は縦型の気相成長装置の概略断面図であり、縦型の反応容器１の内部に、被成膜基板２はサセプタ３の上に載置して配置される。反応容器１の頂部フランジ板１ａに原料ガスの導入口４が形成されており、このフランジ板に被成膜基板２に原料ガスを導くガスフローチャネル（内筒管）５が取り付けられている。サセプタ３の支持軸体６は反応容器１の底部フランジ板１ｂに設けた軸受７で軸支されており、反応容器の下方の側面部にガス排気口８が設けられている。

【０００４】

【発明が解決しようとする課題】成膜時に被成膜基板２は加熱されるが、これは例えば、反応容器１の周囲に設けた高周波コイル９に通電し、サセプタ３の誘導加熱により間接的に行われる。加熱された被成膜基板２上で分解した原料は、基板上に薄膜を形成するが、その膜形成に寄与しない原料は基板周辺部に存在するガスフローチャネル５、サセプタ３、反応容器１の内壁に付着する。これら付着物は、成膜を繰り返す毎に厚くなり、やがては剥離して反応容器内にゴミ（パーティクル）となって落ち、一部は成膜前の基板の上に落下するようになる。成膜前に基板上に落ちたゴミ（パーティクル）は膜質不良の原因となり、かかるパーティクル汚染は大きな問題である。特に、これらのゴミ（パーティクル）は、反応容器１内を真空に引いたり、真空状態から大気圧に戻す際に飛散し、反応容器内の基板周辺部に位置する部材、

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容器内壁に付着する。そしてこれが成膜前の被成膜基板上に落ちるとパーティクル汚染が生ずる。

【０００５】本発明は、反応容器内を真空引き及び大気圧に戻すときに、被成膜基板周辺部に飛散したゴミ（パーティクル）を捕集し、基板のパーティクル汚染を防ぐことができる気相成長装置の提供を目的とするものである。

【０００６】

【課題を解決するための手段】本発明は、原料ガスの熱分解反応により被成膜基板に薄膜を形成する気相成長装置において、縦型の反応容器と、被成膜基板を載置し、同基板を前記反応容器内に位置させるサセプタと、環状の誘電体及びこの誘電体の外側面に取り付けられた電極を有するパーティクル除去手段と、前記電極に電位を与える直流電源と、前記反応容器の底部に設けられたゴミ受けとを備え、前記パーティクル除去手段は前記サセプタの周囲を覆う位置と前記ゴミ受けの位置に昇降可能であることを特徴とするものである。

【０００７】

【作用】被成膜基板の搬出入に係る、反応容器内を大気圧に戻したり、真空に引くときに、被成膜基板を載置したサセプタの周囲にパーティクル除去手段を位置させ、直流電源によって電極に電位を与えて誘電体を帯電させ、飛散し、舞い上がるパーティクルを誘電体に付着させる。反応容器内の圧力状態が安定したときにパーティクル除去手段をゴミ受けの位置まで下げ、パーティクルをゴミ受けに落す。

【０００８】

【実施例】本発明の実施例について図１の断面構成図を参照して説明する。なお、図１において、図２と同一符号は同一若しくは同等部分を示す。被成膜基板２は縦型の反応容器１内に、サセプタ３に載置して配置される。反応容器１の頂部フランジ板１ａに原料ガスの導入口４が形成されており、このフランジ板に被成膜基板２に原料ガスを導くガスフローチャネル５が取り付けられている。サセプタ３の支持軸体６は反応容器１の底部フランジ板１ｂに設けた軸受７で軸支されている。

【０００９】サセプタ３の周囲を覆って位置できるパーティクル除去手段１１を設ける。同手段は環状の誘電体１２とその外側面に取り付けられた電極１３を有する。パーティクル除去手段１１には導電体製の支持部材１４，１４’が取り付けられており、これら支持部材は電極１３と電気的に接続されている。そして、支持部材１４，１４’は反応容器１の下部フランジ板１ｂに取り付けた真空シール機能を有する絶縁軸支部材１５，１５’に摺動可能に支持されており、一方の支持部材１４は直流電源１６に接続し、電極１３にアース電位にされている反応容器１、サセプタ３、ガスフローチャネル５等に対して所要極性の電位を印加できるようにしている。

【００１０】反応容器１の底部フランジ板１ｂの上には

ゴミ受け１７が設けられており、電流導入端子１５，１５’はその上部がゴミ受けを貫通して位置している。ガス排気口８はゴミ受け１７より上方に位置して設けられている。

【００１１】原料ガスは、ガス導入口５から反応容器１内に導入される。被成膜基板２は、例えば高周波コイル９により誘導加熱或いは内蔵ヒータにより抵抗加熱されるサセプタ３を介して間接的に加熱され、原料ガスは熱分解し、被成膜基板上に所望の薄膜が形成される。前述したように、成膜に寄与しなかった原料は、被成膜基板２の周辺の反応容器１の内壁、サセプタ３、ガスフローチャネル６に付着し、この付着物、ゴミ，パーティクルは、特に、反応容器１内を真空引きしたり、減圧状態から大気圧状態に戻すときに舞い上がる可能性が高い。

【００１２】反応容器１の側面部には、その図示を省略するが、被成膜基板２を搬出入するロードロック室がゲートバルブを介して結合されており、被成膜基板２の反応容器１内のサセプタ３への搬入、サセプタからの搬出はロードロック室を介して大気圧下で行われる。未成膜基板の搬入時、大気圧状態にあるロードロック室から、同じく大気圧の反応容器１内のサセプタ３に被成膜基板２を搬送し、反応容器１とロードロック室間のゲートバルブを閉じる。パーティクル除去手段１１を図示位置、被成膜基板２を載置したサセプタ３の周囲に位置させる。直流電源１６によって電極１３にサセプタ３に対して所要極性の電位を与え、誘電体１２を帯電させる。反応容器１内を真空引きする。このとき飛散し、舞い上がったパーティクルは帯電した誘電体１２に静電引力で引き寄せ、付着させ、被成膜基板２のパーティクル汚染を防止する。パーティクル除去手段１１における電極１３の印加電位は例えば数１００Ｖ程度である。

【００１３】反応容器１内の真空減圧が安定した状態で、パーティクル除去手段１１の支持部材１４，１４’を操作し、同除去手段をゴミ受け１７の位置まで下げ、原料ガスの流れに影響を与えないようにし、成膜運転を行う。このパーティクル除去手段１１を下げた状態で直流電源１６を操作し、金属製電極１３の印加電位を逆極性の電位又はアース電位にすることにより、誘電体１２に付着したパーティクルをゴミ受け１７に落し込むことができる。

【００１４】成膜済み基板を反応容器１から搬出するときには、パーティクル除去手段１１の支持部材１４，１４’を操作し、同除去手段をサセプタ３の周囲位置に上昇させ、電極１３に所要極性の電位を与え、誘電体１２を帯電させる。反応容器１内を不活性ガスでパージしてから大気圧に戻す。このとき飛散し、舞い上がったパーティクルを帯電した誘電体１２に付着させ、捕集する。

【００１５】

【発明の効果】本発明は、以上説明したように構成したので、反応容器内を大気圧にしたり、真空引きしたときに飛散し、舞い上がるパーティクルをパーティクル除去手段の誘電体に静電付着、捕集することができるから、特に、成膜直前の被成膜基板がパーティクル汚染されるのを防止することができ、膜質不良が生ずる割合を著しく減少させることができる。

【図面の簡単な説明】

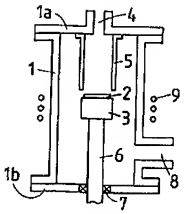
【図１】本発明の実施例の断面構成図である。

【図２】従来の縦型の気相成長装置の断面図である。

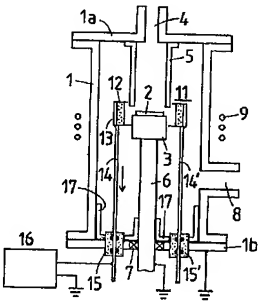
【符号の説明】

１　反応容器
２　被成膜基板
３　サセプタ
５　ガスフローチャネル
１１　パーティクル除去手段
１２　誘電体
１３　電極
１４，１４’　支持部材
１５，１５’　絶縁軸支部材
１６　直流電源
１７　ゴミ受け

【図２】



【図1】



PATENT ABSTRACTS OF JAPAN

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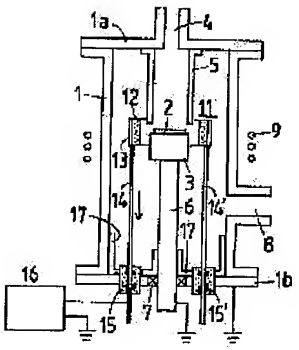
(54) THIN-FILM VAPOR PHASE GROWTH DEVICE

(57)Abstract:

PROBLEM TO BE SOLVED: To allow scattering particles to be made to static-adhere to the dielec tric as a means for removing particles for collection by positioning the particle removing means around a susceptor when the inside of a reaction container is released at an atmospheric pressure or evacuated and by applying potential to an electrode by DC currecnt.

SOLUTION: A particle removing means 11 provided with an annular dielectric 12 and circular electrode 13 is prepared around a susceptor 3. Supporting members 14 and 14' made of dielectric are attached to the means 11 and are connected with the electrode 13. The member 14 is connected to a DC power supply 16. A potential is applied to the electrode 13 through the DC power supply 16 to charge the dielectric 12. The scattered particles at this time are adhered to the dielectric 12 thanks to its static attracting force, thereby preventing a substrate 2 for forming a film thereon from particle contamination. The means 11 is lowered to the position of a dust receiver 17. In such a state, the applied potential of the metallic electrode 13 is set to reverse polarity or ground potential and the particles adhering on the dielectric 12 are dropped into the receiver 17.



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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application] this invention relates to organic-metal thin film vapor-growth equipment etc., and relates to the vapor-growth equipment which prevented particle contamination of the substrate formed membranes.
[0002]
[Description of the Prior Art] Vapor-growth equipments, such as organic-metal thin film vapor-growth (MOCVD) equipment, produce a pyrolysis reaction on the substrate which made the raw material the shape of a gas (gas), supplied it, and heated it formed membranes, and form a desired thin film. When vapor-growth equipment is roughly divided, it has the vapor-growth equipment of the horizontal type which passes material gas from a horizontal direction and width, and vapor-growth equipment of the vertical mold which sprays material gas perpendicularly to the substrate placed horizontally in a reaction container formed membranes.
[0003] Drawing 2 is the outline cross section of the vapor-growth equipment of a vertical mold, and the substrate 2 formed membranes is laid and arranged inside the reaction container 1 of a vertical mold at a susceptor 3 top. The inlet 4 of material gas is formed in top flange board 1a of the reaction container 1, and the gas flow channel (container-liner pipe) 5 which leads material gas to this flange board at the substrate 2 formed membranes is attached. The support axis 6 of a susceptor 3 is supported to revolve with the bearing 7 prepared in pars-basilaris-ossis-occipitalis flange board 1b of the reaction container 1, and the flueing mouth 8 is formed in the lateral portion of the lower part of a reaction container.
[0004]
[Problem(s) to be Solved by the Invention] Although the substrate 2 formed membranes is heated at the time of membrane formation, this is energized to the high frequency coil 9 prepared in the circumference of the reaction container 1, and is indirectly performed by the IH of a susceptor 3. Although the raw material disassembled on the heated substrate 2 formed membranes forms a thin film on a substrate, the raw material which is not contributed to the film formation adheres to the wall of the gas flow channel 5 which exists in a substrate periphery, a susceptor 3, and the reaction container 1. Whenever it repeats membrane formation, it becomes thick, these affixes are ******(ed) soon, into a reaction container, serve as dust (particle), and fall, and a part comes to fall on the substrate before membrane formation. The dust (particle) which fell on the substrate before membrane formation becomes the cause that membraneous quality is poor, and this particle contamination is a big problem. In case especially these dust (particle) lengthens the inside of the reaction container 1 to a vacuum or returns it to atmospheric pressure from a vacua, it disperses, and it adheres to the member and container wall which are located in the substrate periphery in a reaction container. And if it falls on the substrate before this forming membranes formed membranes, particle contamination will arise.
[0005] When returning the inside of a reaction container to vacuum length and atmospheric pressure, this invention carries out the uptake of the dust (particle) which dispersed in the formed membranes substrate periphery, and aims at offer of the vapor-growth equipment which can prevent particle

contamination of a substrate.
[0006]
[Means for Solving the Problem] In the vapor-growth equipment with which this invention forms a thin film in the substrate formed membranes by the pyrolysis reaction of material gas The reaction container of a vertical mold, and the susceptor which the substrate formed membranes is laid [susceptor] and locates this substrate in the aforementioned reaction container, A particle removal means to have the electrode attached in the annular dielectric and the outside side of this dielectric, It has the DC power supply which give potential to the aforementioned electrode, and the dust receptacle prepared in the bottom of the aforementioned reaction container, and the aforementioned particle removal means is characterized by the ability to go up and down the circumference of the aforementioned susceptor in a wrap position and the position of the aforementioned dust receptacle.
[0007]
[Function] When returning the inside of the reaction container concerning the taking-out close of the substrate formed membranes to atmospheric pressure or lengthening it to a vacuum, a particle removal means is located in the circumference of the susceptor which laid the substrate formed membranes, it electrifies a dielectric and disperses and the particle where it soars is made to give potential to an electrode by DC power supply, and to adhere to a dielectric. When the pressure state in a reaction container is stabilized, a particle removal means is lowered to the position of a dust receptacle, and particle is dropped on a dust receptacle.
[0008]
[Example] The example of this invention is explained with reference to the cross-section block diagram of drawing 1 . In addition, in drawing 1 , the same sign as drawing 2 shows the same or an equivalent portion. The substrate 2 formed membranes is laid and arranged in the reaction container 1 of a vertical mold at a susceptor 3. The inlet 4 of material gas is formed in top flange board 1a of the reaction container 1, and the gas flow channel 5 which leads material gas to this flange board at the substrate 2 formed membranes is attached. The support axis 6 of a susceptor 3 is supported to revolve with the bearing 7 prepared in bottom flange board 1b of the reaction container 1.
[0009] A particle removal means 11 by which the circumference of a susceptor 3 is covered and it can be located is established. This means has the electrode 13 attached in the annular dielectric 12 and its outside side. The supporter material 14 made from a conductor and 14' are attached in the particle removal means 11, and these supporter material is electrically connected with the electrode 13. and the insulating support which has the vacuum seal function in which the supporter material 14 and 14' were attached in lower flange board 1b of the reaction container 1 -- it is supported by a member 15 and 15' possible [sliding], and it connects with DC power supply 16, and one supporter material 14 enables it to impress the potential of necessary polarity to an electrode 13 to the reaction container 1 made into ground potential, a susceptor 3, and gas flow channel 5 grade
[0010] The dust receptacle 17 is formed on bottom flange board 1b of the reaction container 1, the upper part penetrates a dust receptacle and the current introduction terminal 15 and 15' are located. From the dust receptacle 17, the flueing mouth 8 is located up and prepared.
[0011] Material gas is introduced in the reaction container 1 from a gas inlet 5. The substrate 2 formed membranes is indirectly heated through the susceptor 3 in which resistance heating is carried out by the high frequency coil 9 at IH or a built-in heater, material gas pyrolyzes and a desired thin film is formed on the substrate formed membranes. As mentioned above, the raw material which was not contributed to membrane formation adheres to the wall of the surrounding reaction container 1 of the substrate 2 formed membranes, a susceptor 3, and the gas flow channel 6, and its possibility of soaring at this affix, dust, and especially particle when carrying out vacuum length of the inside of the reaction container 1 or returning it to an atmospheric pressure state from a reduced pressure state is high.
[0012] Although the illustration is omitted, the load lock chamber which carries out taking-out close [of the substrate 2 formed membranes] is combined through the gate valve by the lateral portion of the reaction container 1, and carrying in to the susceptor 3 in the reaction container 1 of the substrate 2 formed membranes and taking out from a susceptor are performed to it under atmospheric pressure

through a load lock chamber. At the time of carrying in of the substrate non-formed membranes, from the load lock chamber in an atmospheric pressure state, similarly the substrate 2 formed membranes is conveyed to the susceptor 3 in the reaction container 1 of atmospheric pressure, and the gate valve between the reaction container 1 and a load lock chamber is closed. The particle removal means 11 is located in the circumference of the susceptor 3 which laid the illustration position and the substrate 2 formed membranes. By DC power supply 16, the potential of necessary polarity is given to an electrode 13 to a susceptor 3, and a dielectric 12 is electrified. Vacuum length of the inside of the reaction container 1 is carried out. Dispersing at this time, the particle where it soared is made to draw near and adhere to the electrified dielectric 12 in an electrostatic attraction, and prevents particle contamination of the substrate 2 formed membranes. The impression potential of the electrode 13 in the particle removal means 11 is about number 100V.

[0013] Where the vacuum reduced pressure in the reaction container 1 is stabilized, operate the supporter material 14 of the particle removal means 11, and 14', lower this removal means to the position of the dust receptacle 17, it is made not to affect the flow of material gas, and membrane formation operation is performed. The particle adhering to the dielectric 12 can be dropped into the dust receptacle 17 by operating DC power supply 16, where this particle removal means 11 is lowered, and making impression potential of the metal electrode 13 into the potential or ground potential of reversed polarity.

[0014] When taking out the substrate formed membranes from the reaction container 1, the supporter material 14 of the particle removal means 11 and 14' are operated, this removal means is raised in the circumference position of a susceptor 3, the potential of necessary polarity is given to an electrode 13, and a dielectric 12 is electrified. After purging the inside of the reaction container 1 by inert gas, it returns to atmospheric pressure. It disperses at this time, and the particle where it soared is made to adhere to the electrified dielectric 12, and carries out a uptake.

[0015]

[Effect of the Invention] Since this invention was constituted as explained above, it can disperse, when the inside of a reaction container is made into atmospheric pressure or vacuum length is carried out, and the rate from which it can prevent electrostatic adhesion and that particle contamination of the substrate in front of membrane formation formed membranes is especially carried out since a uptake can be carried out to the dielectric of a particle removal means, and membraneous [poor] produces the particle where it soars can be decreased remarkably.

[Translation done.]